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2071
Back-Pack Ethylene Applicator

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Ethylene gas (C_2H_4) is used to induce suicidal germination of witchweed (*Striga asiatica*) seed. The gas is injected into the soil to the depth of approximately 20 cm. Here it diffuses throughout the soil causing witchweed seed to germinate. Effectiveness of the treatment is dependent upon timely application. The seeds must have gone through a period of preconditioning. This preconditioning is brought about by high moisture and greater than 20° C. temperature regime. Witchweed may grow on host plants in fence rows, around houses and other places which are not accessible to conventional field equipment. (See APHIS 81-18 dated June 1974.)

Description

This equipment herein described is designed to permit treatment with ethylene gas in areas not accessible by tractor-mounted field equipment.

Back-Pack

The carrying system used in the construction of this equipment is a standard aluminum frame back-pack with a hip pad (Figure 1).

Ethylene Container

The cylinder for containing the ethylene gas is an 11 cm x 68 cm cylinder with a minimum test pressure of 25 g/cm² (1800 psi). The cylinder is fitted with a standard CGA-350 valve. The size of cylinder is not critical, but the 25 g/cm² minimum test is critical. The gas flow from the cylinder to the regulator is through high pressure gas hose with crimped fittings on each end. One fitting must be a swivel.

Regulator

The regulator used is an Air Products and Chemicals, Inc. model E11-K-N515D single stage regulator or equal. This regulator has an inlet pressure rating of 0-42 g/cm² (0-3000) and an outlet pressure of 0-2.8 g/cm² (0-200).

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A cutoff valve is placed in the outlet part of the regulator. A nozzle body (Spraying Systems 1321 $\frac{1}{4}$ T) is screwed onto the cutoff valve. A metering orifice plate (Spraying Systems 4916-40) is placed in an adapter cap (Spraying Systems 4676 $\frac{1}{4}$ NPT) and screwed onto the adapter. A standard air quick couple ($\frac{1}{4}$ " Stewart Warner) is attached to the adapter for uncoupling the probe line. The automatic shut-off part of the quick couple is on the adapter and the probe line has the open nipple. The line to the probe is approximately one meter long plastic tubing (6 mm or $\frac{1}{4}$ " ID) attached with hose clamps.

Probe

The probe is constructed from 2.5 cm (1") square tubing. The handle is approximately 40 cm and the shaft one meter in length (Figure 2). An air type squeeze valve (Speed Air 5X786) is mounted inside one end of the handle. The holder neck is sawed off to permit mounting inside the handle. The tip is removed and discarded. From this valve a small pipe (.30 cm or 1/8") passes through the handle and shaft to the base of the shaft. At the base of the shaft a pipe coupling is attached to the pipe and brazed to the interior of the shaft. With this arrangement, the probe - which is inserted into the ground - is screwed into the coupling. This arrangement permits easy changing of the probe.

The probe is made from a 20 cm (8 in.) piece of pipe (.30 cm or 1/8 in.). One end is threaded and the other filled with brass. The probe is ground to a point, and four holes drilled back from the taper into the internal opening (no. 52 drill bit - 1.5 mm or 1/16 in.).

Operation

The cylinder is filled by pressure equalization. A "bridge line" is attached between the nurse cylinder valve and the back-pack cylinder valve. After pressure equalization both cylinder valves are turned off. The bridge line is removed from the back-pack cylinder and the line to the pressure regulator attached. The back-pack cylinder is then turned on. The primary pressure gauge should indicate cylinder pressure. The outlet pressure regulator knob is adjusted to read the desired operating pressure (.56 g/cm² or 40 psi). The probe line is attached via the quick couple.

As the probe is being inserted into the ground, the air valve on the probe handle is squeezed to release ethylene. This prevents clogging of the outlet holes as the probe is being inserted into the soil. The ethylene is permitted to flow for about one second in the full inserted position. The ethylene should also flow as the probe is extracted from the soil. As soon as the tip of the probe clears the soil, the squeeze valve is released and moved to the next site. Treatments should be applied on a one meter grid to insure saturation of the area. When the pressure of the back-pack cylinder falls below operating pressure (.56 g/cm² or 40 psi), the cylinder is recharged.

Caution

Ethylene is a flammable, compressed gas. Reasonable care in handling the equipment should be used. There should be no smoking or exposed flame while handling or applying ethylene.

Parts List

Item	Manufacturer	Part #
1. Back-pack		
2. High pressure cylinder- approximately 11 cm x 68 cm ($4\frac{1}{2}$ x 27"), minimum pressure 25 g/cm ² (1800 psi) fitted with CGA- 350 valve	Air Products & Chemicals, Inc.; Union Carbide-Linde Division; Matheson Gas Products	
3. CGA connection nipple nut - brass	Air Products & Chemicals, Inc.	$\frac{1}{2}$ " MNPT
4. One meter - high pressure hose with one female (swivel) and one male ($\frac{1}{4}$ " tips)	Air Products & Chemicals, Inc.; Any Hydraulic Supply Service	
5. Single stage regulator CGA-350	Air Products & Chemicals, Inc.	E11-K-N515D
6. Nozzle body	Spraying Systems	1321 $\frac{1}{4}$ T
7. Strainer - 100 mesh	Spraying Systems	
8. Orifice plate	Spraying Systems	4916-40
9. Adapter	Spraying Systems	4676 $\frac{1}{4}$ NPT
10. Std. Air Quick Couple- $\frac{1}{4}$ "	Stewart Warner	
11. Hose Shank (2)	Spraying Systems	8400- $\frac{1}{4}$ 300
12. Air Valve	Speed Air or Equal	
13. Probe - Handle	Fabricated	(See text)
14. Hose Clamps		



Figure 1. Back-pack Ethylene Applicator

Figure 2. Probe assembly for back-pack Ethylene Applicator

